Focusing Light into Deep Subwavelength by a Phase Compensation Metalens

Tech ID: 21251 / UC Case 2010-156-0

BACKGROUND

The imaging resolution of conventional lenses is fundamentally limited by diffraction to approximately half of the working wavelength. Artificially engineered metamaterials offer the possibility of building a “superlens” that overcomes this limit. A single-slab superlens is capable of projecting a sub-diffraction-limited image only in the near field, as the evanescent waves decay away from such a lens. A far-field superlens that has periodic nanoscale corrugations on its top surface enhances the evanescent waves and converts them into propagating waves and can thus project a sub-diffraction-resolution image into the far field. However, such superlenses cannot bring a plane wave into focus or provide magnification due to the lack of a phase compensation mechanism.

TECHNOLOGY DESCRIPTION

UC San Diego researchers have developed a new type of metamaterial-based optical lens that achieves super-resolution focusing through phase compensation and exhibits the basic properties of a conventional optical lens. This “metalens” is comprised of a nonperiodic plasmonic waveguide coupler and a metamaterial slab. Simulations were carried out for a wavelength of 365 nm to verify the metalens concept, proving that the metalens has Fourier transform, deep subwavelength focusing, and imaging capabilities. The potential for super resolution in conjunction with the Fourier transform ability suggest applications in nanoscale imaging, sensing and fabrication, as well as miniaturized devices for optical data processing.

RELATED MATERIALS

“A Super Resolution Metalens with Phase Compensation Mechanism,” Appl. Phys. Lett. 96, 183103 (2010).

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	9,151,891	10/06/2015	2010-156

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OTHER INFORMATION

KEYWORDS

metalens, phase compensation, super resolution, metamaterials, superlens, subwavelength

CATEGORIZED AS

- **Optics and Photonics**
  - All Optics and Photonics
- **Imaging**
  - Other
- **Engineering**
  - Other

RELATED CASES

2010-156-0, 2009-342-1, 2009-342-2